

FISH50:Florida Climate Institute Seasonal Hindcasts at 50km grid resolution

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Special Mention:

Prof. Zhaohua Wu (provided the SST forcing for FISH50)

Dr. Haiqin Li (conducted FISH50 integrations)

Objectives

- What is FISH50?
- Deterministic forecast results
- Probabilistic forecast results
- Comparison of FISH50 with NMME models

FISH50 Design

- FISH50 has been done for the period 1982-2008 (plans are to update to 2012) for winter and summer starts
- The seasonal hindcasts have been initiated in the last (first) week of May (June) of each year for summer and
- Last (first) week of November (December) of each year for winter
- Each seasonal hindcast has 6 ensemble members
- Each seasonal hindcast is for a duration of 6 months.

FISH50 AGCM

- It is a global spectral model run at T248 (~50km).

Table 2: A brief outline of the physics of the FISH50 AGCM

Parameterization	Reference
Cumulus parameterization	Kain-Fritsch (Kain and Fritsch 1993; Kain 2004)
Shallow convection	Tiedtke scheme (Tiedtke 1983)
Boundary layer	Nonlocal scheme (Hong and Pand 1996)
Land surface	NOAH (Chen and Dudhia 2001; Ek et al 2003)
Gravity wave drag	Pierrehumbert (Alpert et al 1988)
Shortwave radiation	M.-D. Chou (Chou and Lee 1996)
Longwave radiation	M.-D. Chou (Chou and Suarez 1994)
Clouds	Slingo 1987

Special features of FISH50

- Relatively high horizontal resolution compared to NMME models
- Different model physics than rest of the NMME models.
- Two tiered system forced by multi-model (CCSM3 and CFSv2) SSTA
- Bias correction of SST done in a very unique and effective manner.

Perils of conventional bias correction of SST for forcing AGCM

- What is conventional bias correction?
 - Hindcast period: 1982 to 2008
 - Replace SST climatology of say CFSv2 hindcasts from 1982-2008 using corresponding observed climatology
- Conventional bias correction of replacing model climatology with observed climatology will unintentionally result in inflating the hindcast skill

Systematic SST errors in CCSM3 and CFSv2 hindcast

Winter hindcasts:

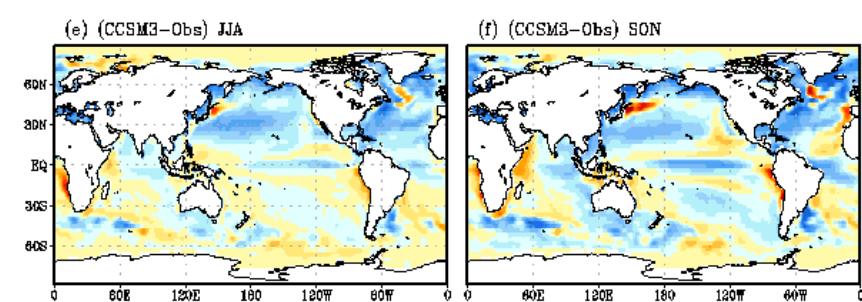
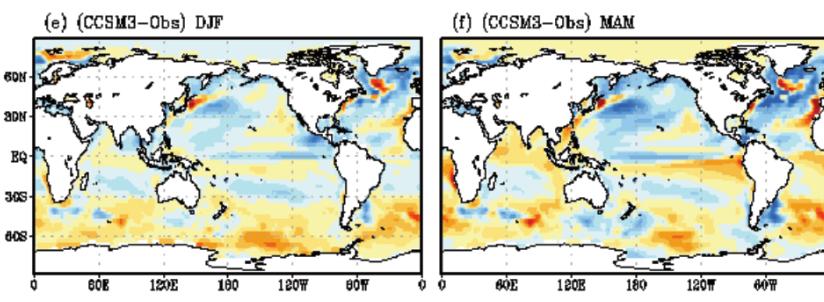
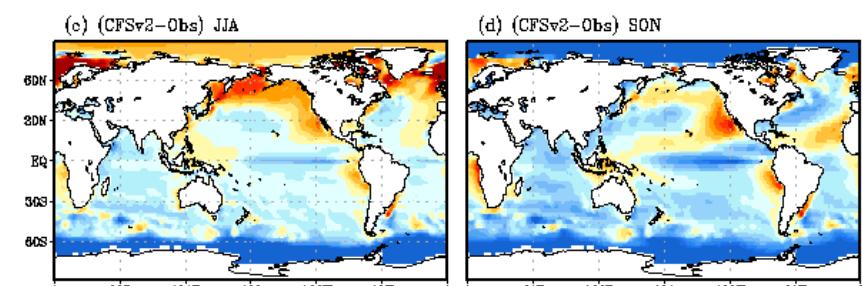
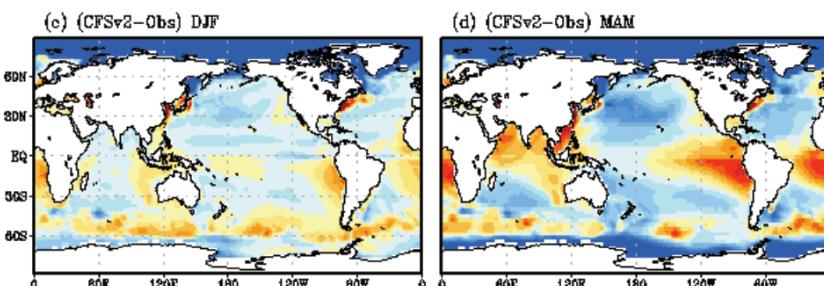
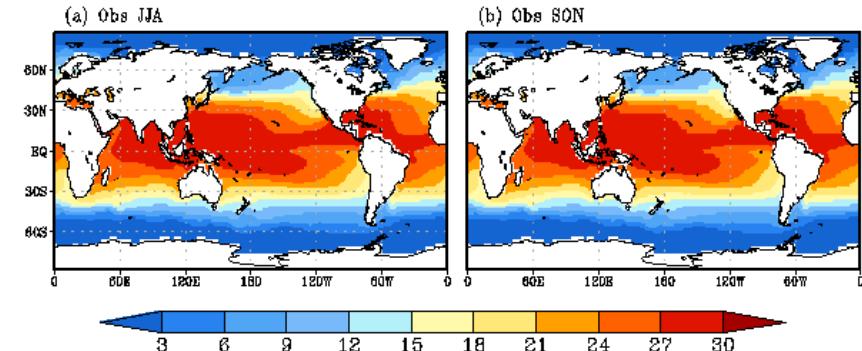
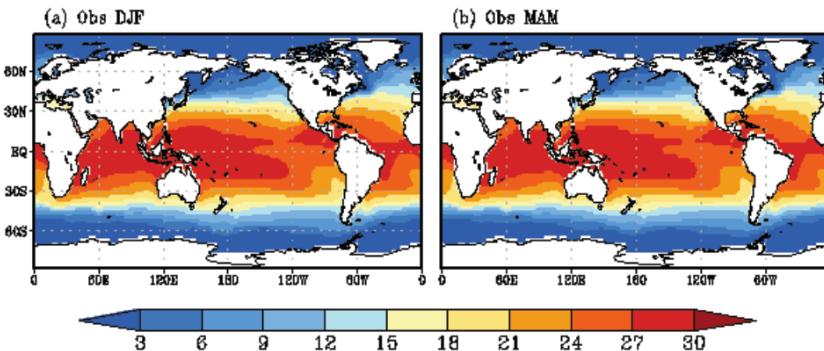
DJF: Zero lead

MAM: One season lead

Summer hindcasts:

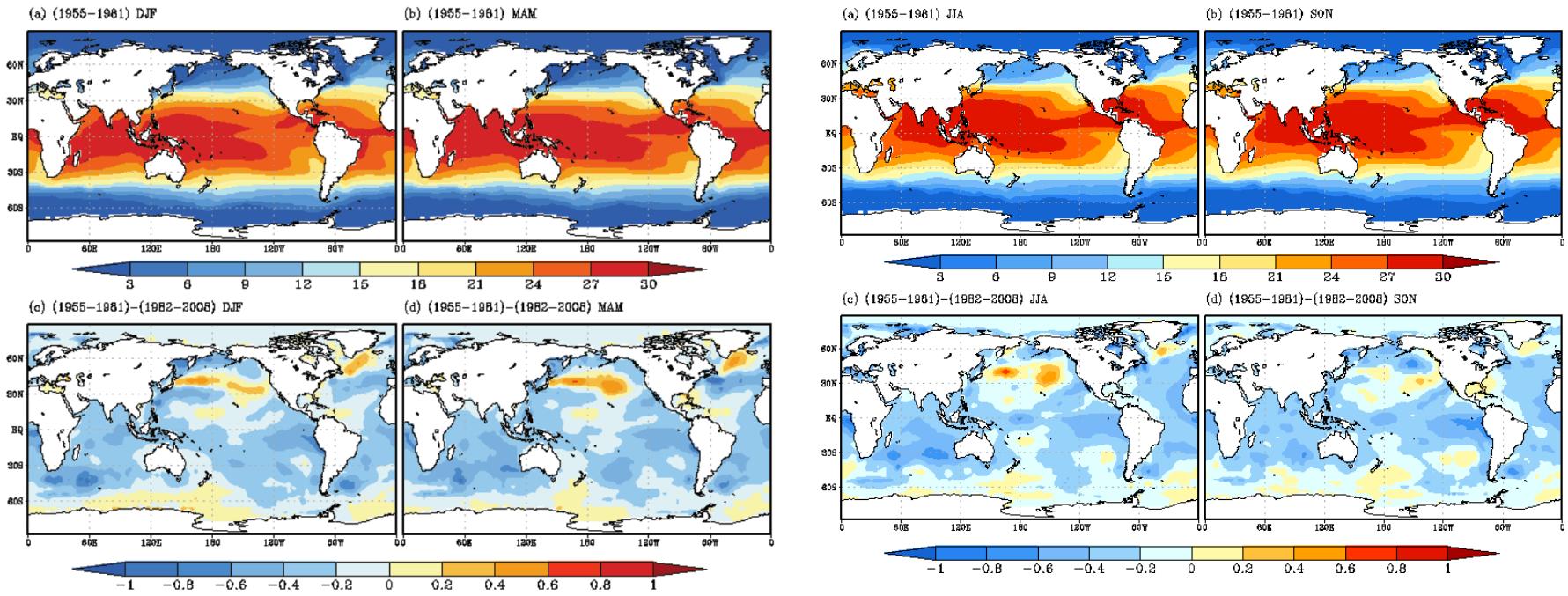
JJA: Zero lead

SON: One season lead



Downside of avoiding conventional bias correction is the risk of deflating the seasonal hindcast skills from a two-tiered system

What if we assume that mean global SST is stationary?



FISH50 SST forcing

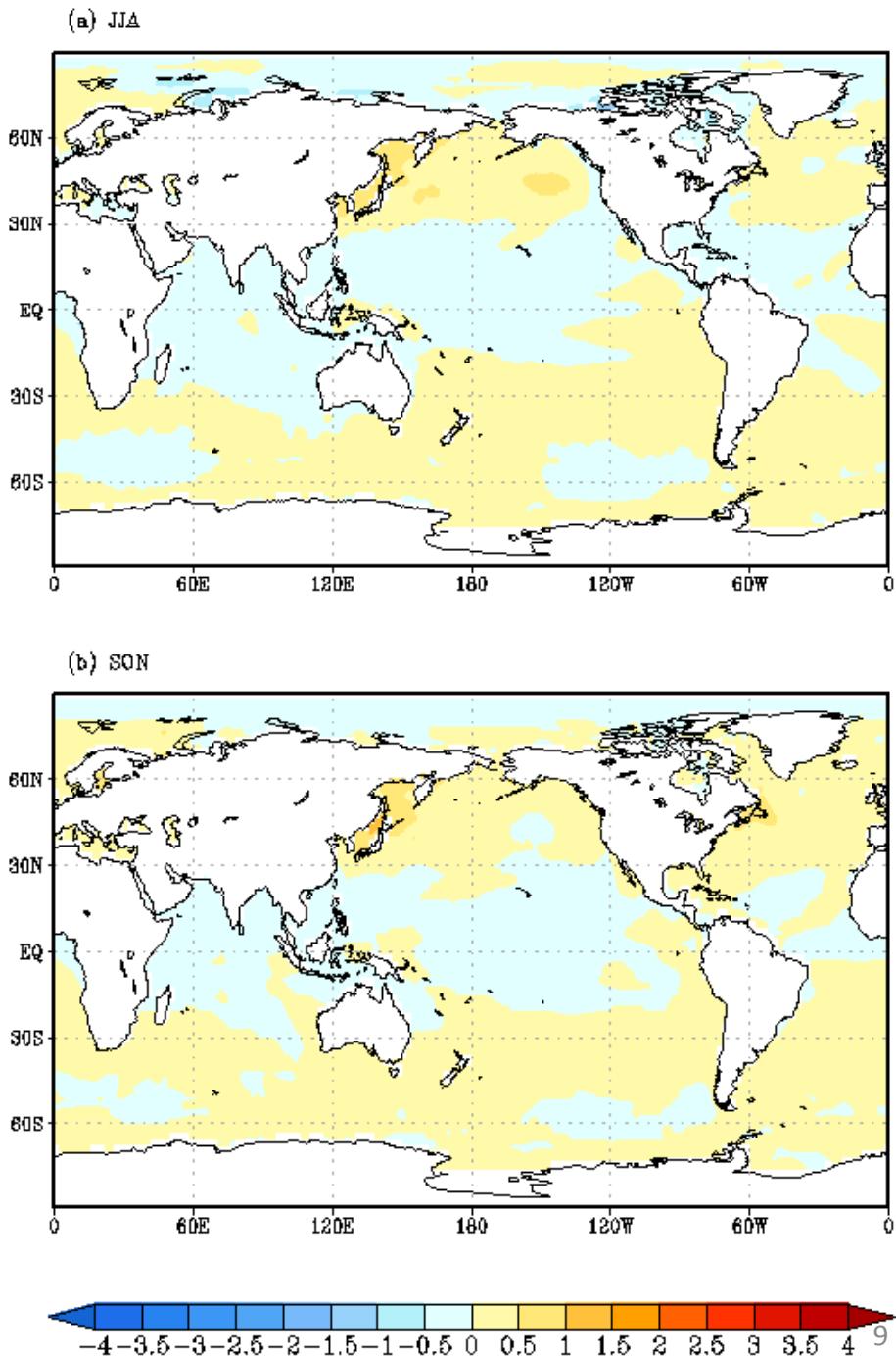
$$SST_F = SST_{OLF} + SSTA_{MME} + SSTA_{acycle}$$

SST_F : is used in FISH50

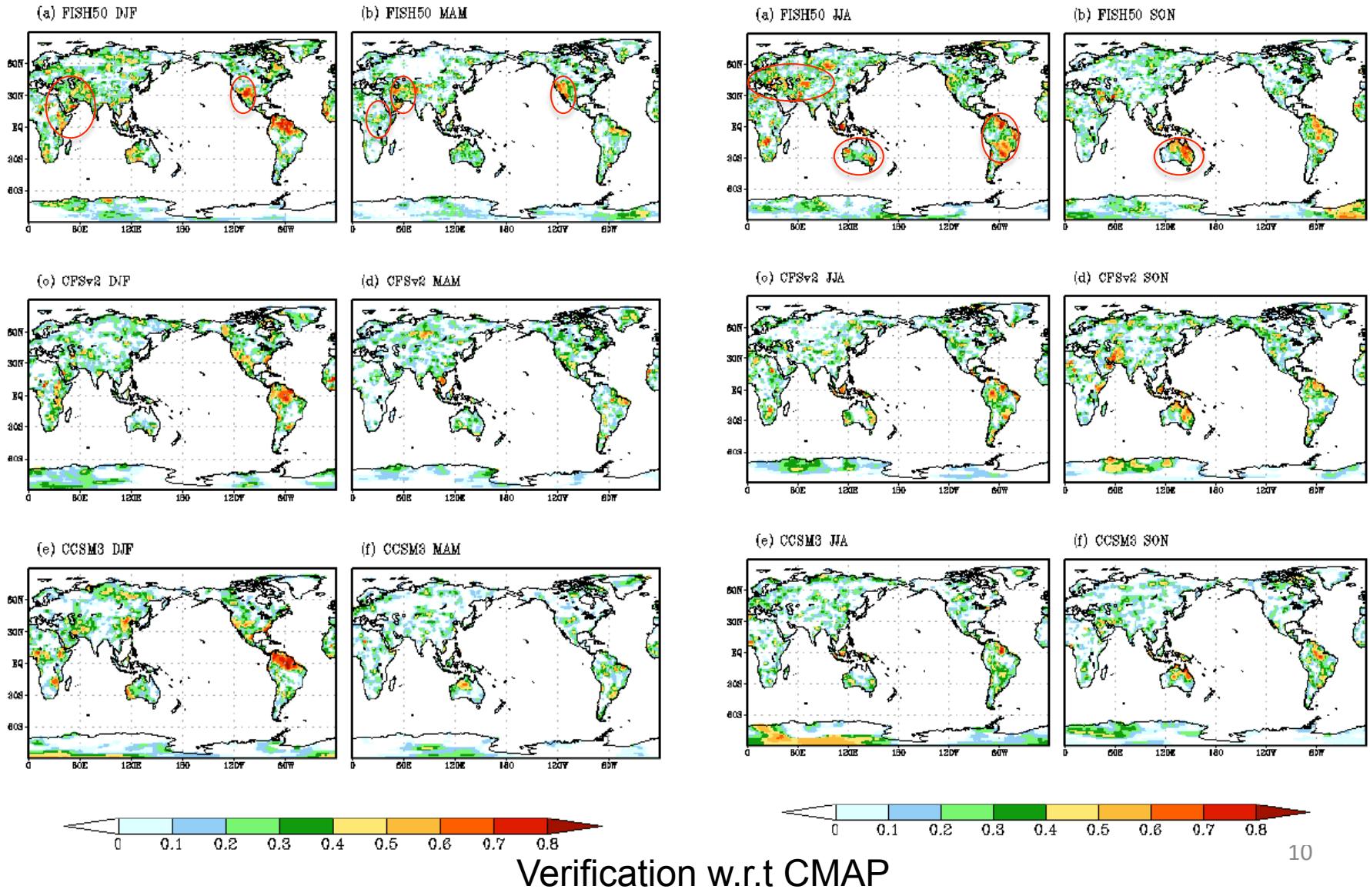
SST_{OLF} : is the observed low pass filtered SST (secular trend +decadal variations; anything with period of ~40years or more is retained) obtained from 1881 to start of seasonal hindcast (updated every year); persisted through the 6 month hindcast period

$SSTA_{MME}$: is the multi-model forecast SST anomaly from CFSv2 and CCSM3

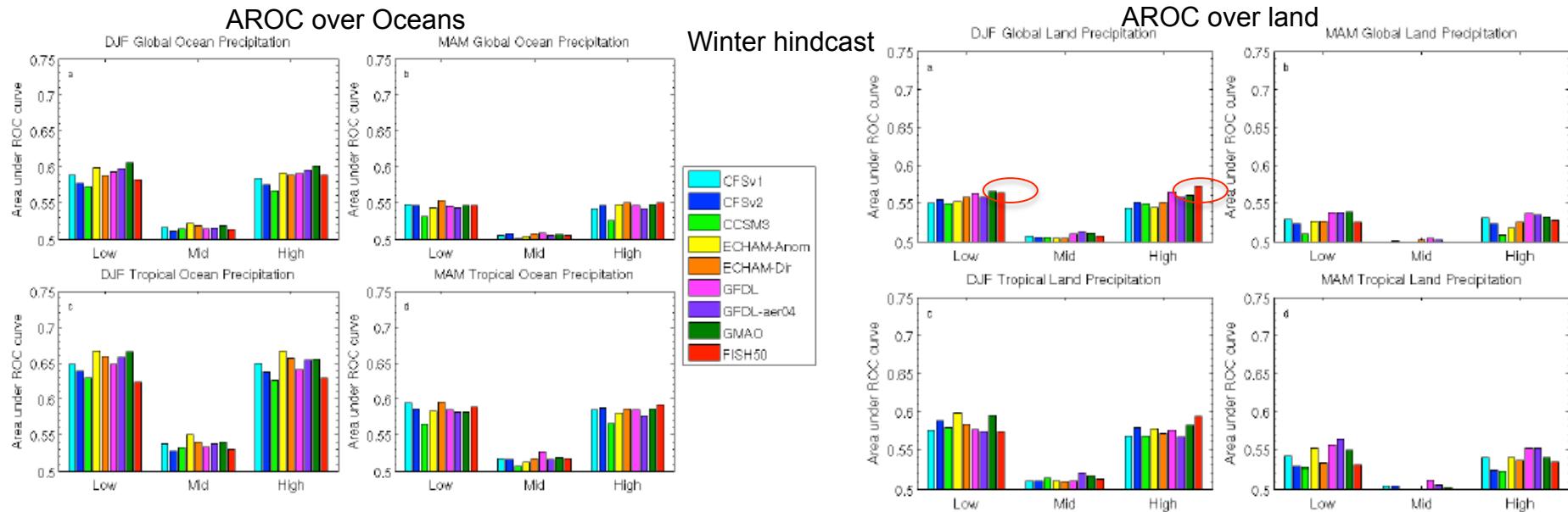
$SSTA_{acycle}$: is the stationary climatological annual cycle



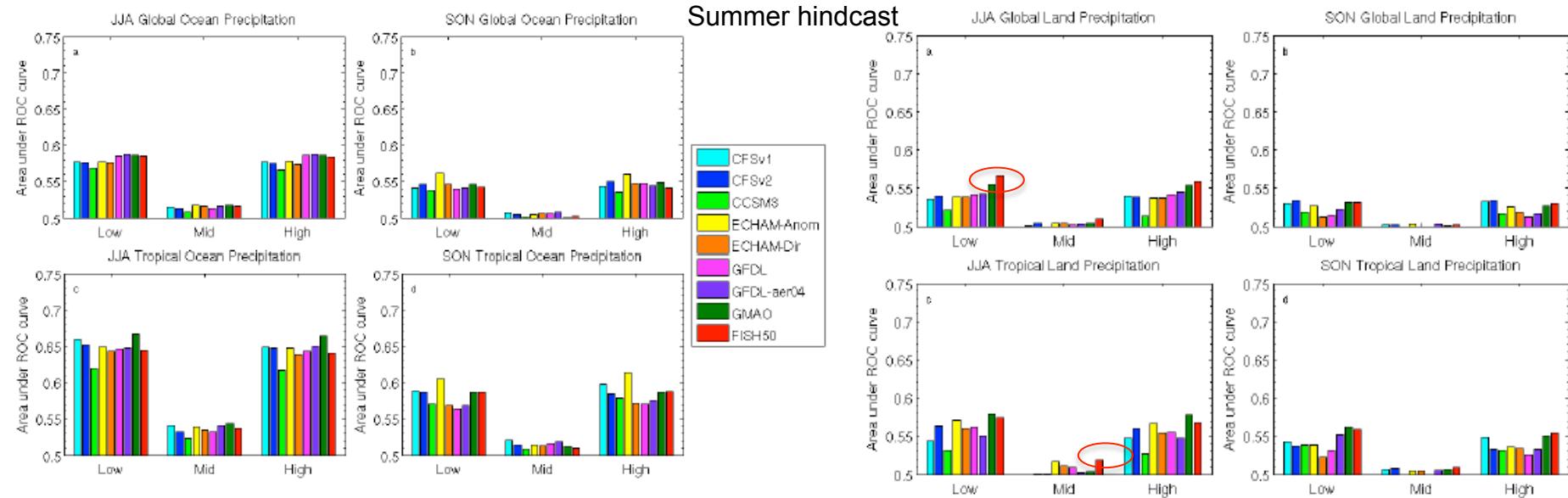
Correlation of ensemble mean seasonal precipitation anomalies



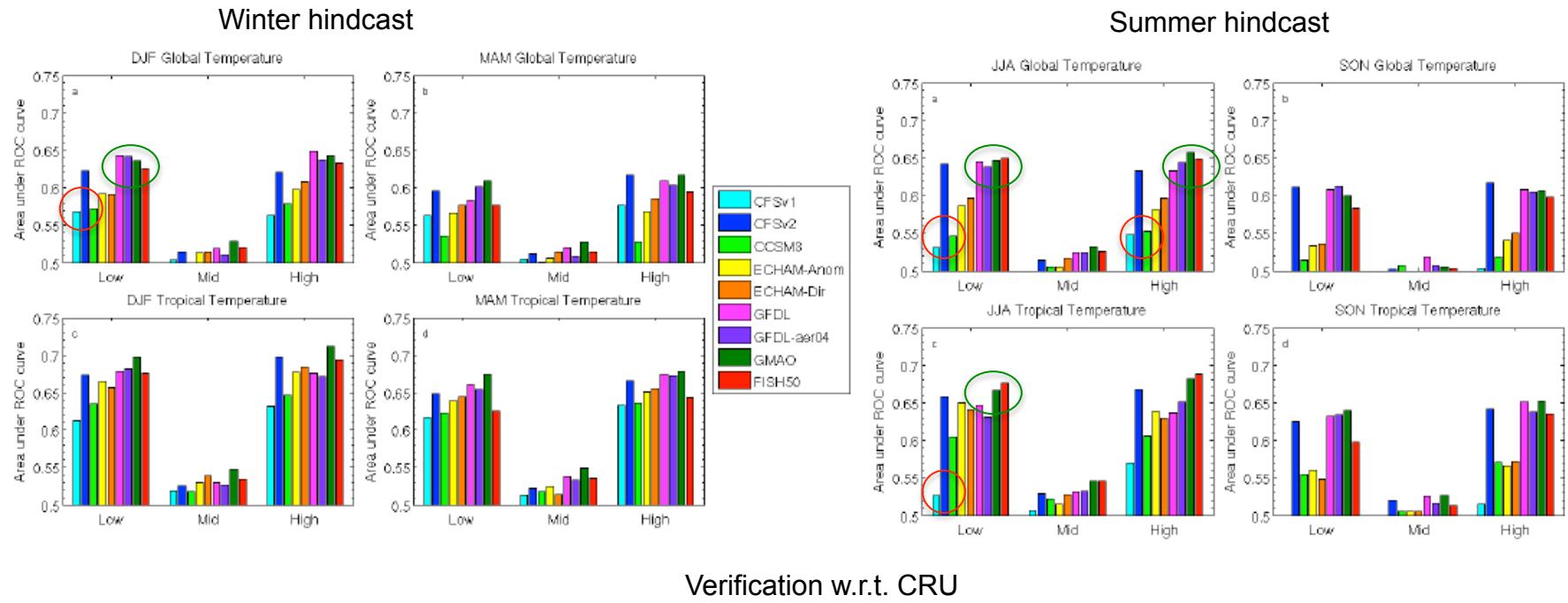
Area under relative operating characteristic curve for tercile seasonal precipitation anomalies



The NMME models and FISH50 have comparable probabilistic skills over the ocean and land



Area under relative operating characteristic curve for tercile seasonal surface temperature anomalies

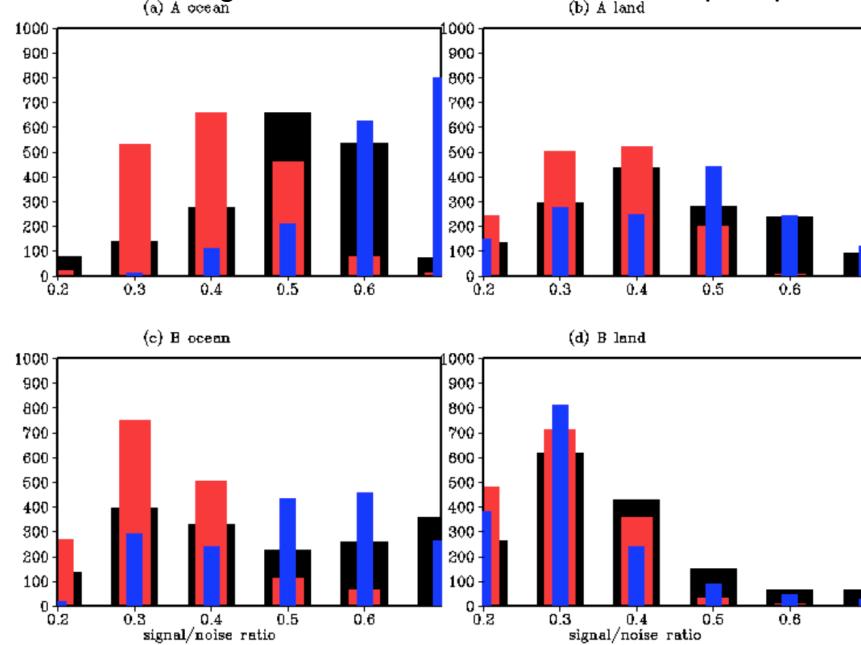


The probabilistic surface temperature skills have more spread in the NMME models

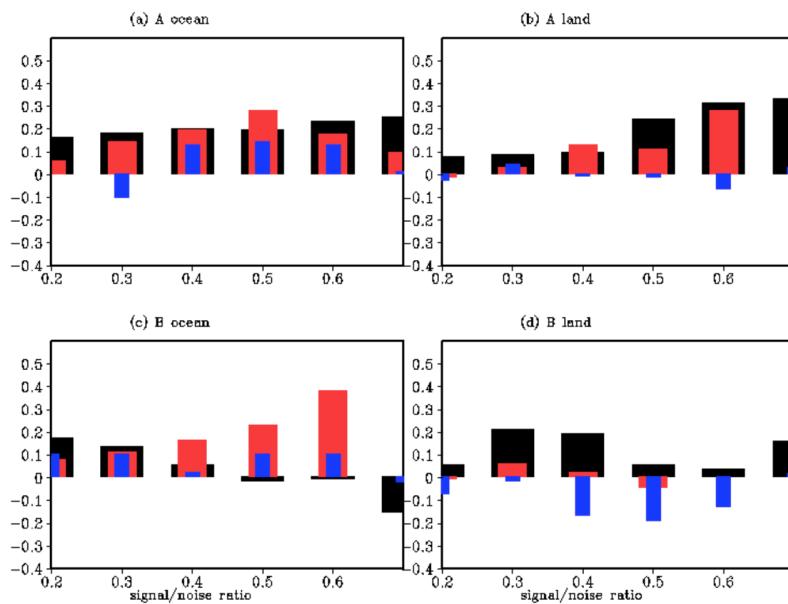
ASIAN SUMMER MONSOON

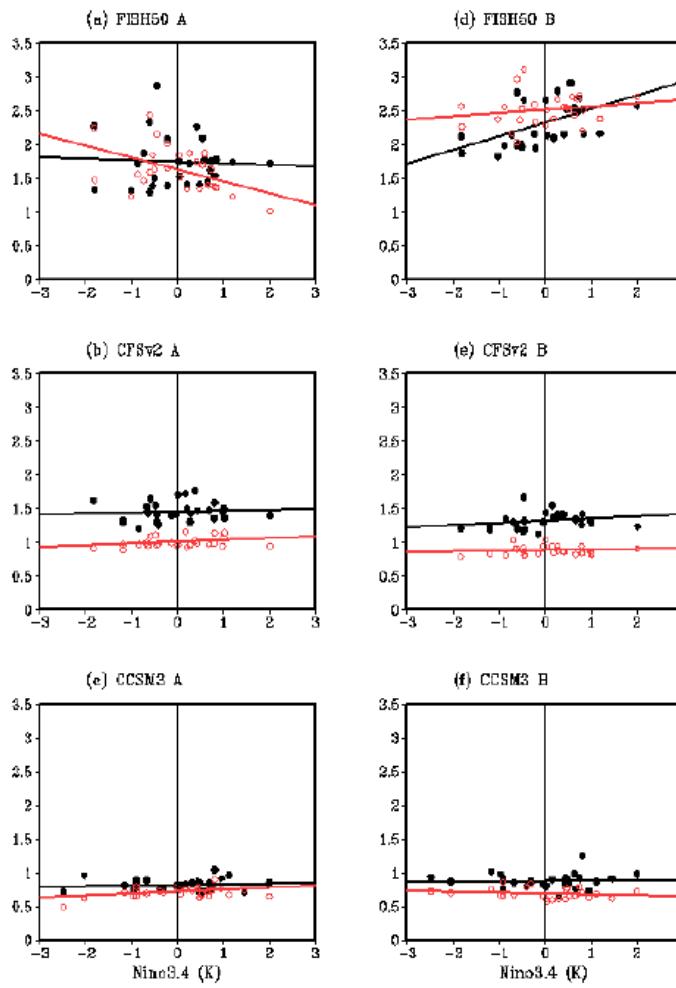
A → South Asian monsoon
 B → Southeast Asian monsoon

Distribution of Signal to Noise ratio for JJAS mean precipitation



Distribution of correlation of seasonal precipitation w.r.t. signal to noise ratio





The ensemble spread of precipitation (measured as the standard deviation about the ensemble mean for each season) as a function of the corresponding mean JJAS Niño3.4 SST index from the three models for ocean and land points in boxes A and B (see Fig. 2). **Ocean** is in black, and **land** is in red. The units of precipitation are in mm day⁻¹ and that for SST anomalies is in Kelvins (K).

Conclusions

- Two tier seasonal prediction is competitive
- Two tier forecasts such as FISH50 serve as a benchmark target for improvement of CGCM prediction initiatives
- ENSO forcing of Indian monsoon continues to be the main source of the seasonal skill even if the relationship is weakening; air-sea interaction could possibly enhance the skill further but possibly the fidelity of the NMME models could be a limiting factor.